

ANNEXURE I

HARCOURT BUTLER TECHNICAL UNIVERSITY DEPARTMENT OF BIOCHEMICAL ENGINEERING SCHOOL OF CHEMICAL TECHNOLOGY

THE UNIVERSITY

VISION

“To achieve excellence in technical education, research and innovation”

MISSION

- 1. Imparting Knowledge to develop analytical ability in science and technology to serve the industry and society at large.*
- 2. Equip and enable students with conceptual, technical and managerial skills to transform the organization and society.*
- 3. Inculcating entrepreneurial philosophy and innovative thinking to promote research, consultancy and institutional social responsibility.*
- 4. Serving people, society and nation with utmost professionalism, values and ethics to make development sustainable and quality of life.*

THE DEPARTMENT

I. Vision

The department of Biochemical Engineering aspires to be globally recognized centre to develop professionals with technical knowledge and skills, leadership qualities and strong ethical values for successful career in Biochemical and allied industries, research and development organizations.

II. Mission

The mission of the Department of Biochemical Engineering -

- M1** : To develop state-of-the-art facilities to impart technical knowledge and skill to the graduate and post graduate students for Biochemical and allied industries and research organizations.
- M2** : To be a center of research and development for betterment of society in sustainable manner.
- M3** : To develop state-of-art the technologies for testing and consultancy for industry and society.
- M4** : To cultivate strong ethical values to be a successful professionals and to become life-long learners.

III. Program Educational objectives (PEOs) for B.Tech. Chemical Technology-Biochemical Engineering -

IV. The educational objectives of B.Tech. Chemical Technology- Biochemical Engineering program are:

- PEO1** : To produce globally competent technical manpower in the field of Biochemical, products , processing and allied areas to cater the need of country
- PEO2** : To impart knowledge for development of innovation designs production materials and processes for sustainable development of society
- PEO3** : To serve the industry to meet the challenges in terms of quality assurance and standardization to with stand the global competitiveness
- PEO4** : To be able to discharge duties with professional attitudes and ethics

Program Outcomes (POs) of B.Tech. Chemical Technology - Biochemical Engineering

Graduating Students of B.Tech. Chemical Technology- Biochemical Engineering program will be able to:

Program Outcomes (POs)		Graduate Attributes(GAs)
PO1	Apply the knowledge of mathematics, science engineering fundamentals and Engineering concepts for the solution of complex engineering problems	Engineering Knowledge
PO2	Identify formulate, review literature and analyze complex problems related to Chemical Technology-Biochemical Engineering reaching substantiated conclusions using first principles of mathematics and engineering sciences	Problem Analysis
PO3	Design solution for complex problems in Chemical Technology- Biochemical Engineering and design system components or process that meet the specified needs with appropriate consideration for the public health and safety, and cultural, societal and environmental considerations	Design/ Development of solutions
PO4	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions	Conduct Investigations of complex problems
PO5	Create, select and apply appropriate techniques, resources and modern engineering tools such as optimization techniques, simulations, including predication and modeling to complex process engineering problems with an understanding of their limitations.	Modern Tool Usage
PO6	Apply contextual knowledge with justification to assess societal, health, safety, legal and cultural issues and the	The Engineer & Society

	consequent responsibilities relevant to engineering and Chemical Technology- Biochemical Engineering professional practice	
PO7	Understand the impact of the professional engineering and Chemical Technology- Biochemical Engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development	Environment and sustainability
PO8	Apply ethical principles and commit to professional ethics adhering to the norms of the engineering and Chemical Technology- Biochemical Engineering practice	Ethics
PO9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings	Individual and team work
PO10	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	Communication
PO11	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	Project management and finance
PO12	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	Life-long learning

HARCOURT BULTER TECHNICAL UNIVERSITY KANPUR**SCHOOL OF CHEMICAL TECHNOLOGY****DEPARTMENT OF BIOCHEMICAL ENGINEERING****Semester wise Course Structure****B. Tech. Chemical Technology –Biochemical Engineering****(Applicable from Session 2019-2020 for new entrants)****Year I, Semester-I**

S. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	MSE	TA	Lab	Total		
1	BSC	Engineering Chemistry	BCY 151	4	3	0	2	15	20	15	50	50	100
2	BSC	Mathematics I	BMA 151	4	3	1	0	30	20	-	50	50	100
3	ESC	Electronics & Instrumentation Engineering	EET 151	3	3	0	0	30	20	-	50	50	100
4	ESC	Engineering Graphics	ECE 151	3	2	4	0	30	20	-	50	50	100
5	ESC	Computer Concepts & Programming	ECS 151	4	3	0	2	15	20	15	50	50	100
6	ESC	Workshop Practice	EWS 151	2	0	0	4	00	20	30	50	50	100
7	MC(Non-Credit)	Environment & Ecology	ECE 153	0	2	0	0	30	20	-	50	50	100*
Total Credits: 20												600	

* 100 marks will not be added as the course is non-credit.

(Applicable from Session 2019-2020 for new entrants)**Year I, Semester-II**

S. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	MSE	TA	Lab	Total		
1	BSC	Physics	BPH 152	4	3	0	2	15	20	15	50	50	100
2	BSC	Mathematics II	BMA 152	4	3	1	0	30	20	-	50	50	100
3	ESC	Electrical Engineering	EEE 152	4	3	0	2	15	20	15	50	50	100
4	ESC	Engineering Mechanics	EME 152	3	3	0	0	30	20	-	50	50	100
5	HSMC	English Language & Composition	HHS 152	2	2	0	0	30	20	-	50	50	100
6	HSMC	Professional Communication	HHS 154	3	2	0	2	15	20	15	50	50	100
Total Credits: 20												600	

**(Applicable from Session 2020-2021)
Year II, Semester-III**

S. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	MSE	TA	Lab	Total		
1	BSC	Mathematics III	BMA 251	4	3	1	0	30	20	-	50	50	100
2	PCC	Materials & Energy Balance	TBE 251	4	3	1	0	30	20	-	50	50	100
3	ESC	Fluid Mechanics and Mechanical Operation	TBE 253	5	3	1	2	15	20	15	50	50	100
4	PCC	Microbiology	TBE 255	4	3	1	0	30	20	-	50	50	100
5	PCC	Microbiology Lab	TBE 257	2	0	0	4	-	20	30	50	50	100
6	HSMC	Organizational Behaviour	HHS 253	3	3	0	0	30	20	-	50	50	100
7	MC (Non-Credit)	Cyber Security	ECS 255	0	2	0	0	30	20		50	50	100*
Total Credits: 22													600

* 100 marks will not be added as the course is non-credit.

(Applicable from Session 2020-2021)
Year II, Semester-IV

S. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	MSE	TA	Lab	Total		
1	BSC	Modern Analytical Techniques	BCY 252	4	3	0	2	15	20	15	50	50	100
2	ESC	Computer Oriented Numerical Methods	BMA 252	4	2	1	2	15	20	15	50	50	100
3	PCC	Heat Transfer Operations	TBE 252	3	3	0	0	30	20	-	50	50	100
4	PCC	Chemical Engineering Thermodynamics	TBE 254	3	3	0	0	30	20	-	50	50	100
5	PCC	Biochemistry	TBE 256	5	3	1	2	15	20	15	50	50	100
6	HSMC	Engg Economics & Management	HHS 252	3	3	0	0	30	20	-	50	50	100
7	MC (Non-Credit)	Indian Constitution (Audit course)	HHS 256	0	2	0	0	30	20		50	50	100*
Total Credits: 22												600	

* 100 marks will not be added as the course is non-credit.

(Applicable from Session 2021-2022)
Year III, Semester-V

S. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	MSE	TA	Lab	Total		
1	PCC	Mass Transfer Operations	TBE 351	4	3	1	0	30	20	-	50	50	100
2	PCC	Chemical Reaction Engineering	TBE 353	3	3	0	0	30	20	-	50	50	100
3	PCC	Molecular Biology & Genetic Engineering	TBE 355	4	3	0	2	15	20	15	50	50	100
4	PCC	Bioprocess Engineering	TBE 357	5	3	0	4	15	20	15	50	50	100
5	PCC	Bioinformatics	TBE 359	3	3	0	0	30	20	-	50	50	100
6	OEC (Humanities)	Entrepreneurship Development	HHS 341	3	3	0	0	30	20	-	50	50	100
Total Credits: 22												600	

(Applicable from Session 2021-2022)
Year III, Semester-VI

S. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	MSE	TA	Lab	Total		
1	PCC	Instrumentation & Process Control	TBE 352	3	2	1	0	30	20	-	50	50	100
2	PCC	Down Stream Processing	TBE 354	3	2	1	0	30	20	-	50	50	100
3	PCC	Fermentation Technology	TBE 356	4	3	1	0	30	20	-	50	50	100
4	PCC	Environmental Biotechnology	TBE 358	3	3	0	0	30	20	-	50	50	100
5	PCC	Bioreaction Engineering	TBE 360	3	3	0	0	30	20	-	50	50	100
6	PCC	Fermentation Technology	TBE 362	3	0	0	6	-	20	30	50	50	100
7	OEC (Maths)	Operations Research	BMA 342	3	3	0	0	30	20	-	50	50	100
Total Credits: 22												700	

(Applicable from Session 2022-2023)
Year IV, Semester-VII

S. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	MSE	TA	Lab	Total		
1	PCC	Enzyme Engineering & Technology	TBE 451	3	2	0	2	15	20	15	50	50	100
2	PCC	Bioreactor Design	TBE 453	2	2	0	0	30	20	-	50	50	100
3	PEC	Program Elective Course I IPR & Biosafety regulation	TBE 455	3	3	0	0	30	20	-	50	50	100
		Food Biotechnology	TBE 457										
4	PEC	Program Elective Course II Plant Cell Biotechnology, Novel Bioproducts	TBE 459	3	3	0	0	30	20	-	50	50	100
			TBE 461										
5	OEC (Biochem)	Principles of Biochemical Engineering	TBE 491	3	3	0	0	30	20	-	50	50	100
6		Industrial Training	TBE 493	2	0	0	4		50		50	50	100
7		Seminar	TBE 495	2	0	0	4		50		50	50	100
8		Project	TBE 497	4	0	0	8		50		50	50	100
9		Educational Tour	TBE 499	0	0	0	0						
Total Credits: 22												800	

**(Applicable from Session 2022-2023)
Year IV, Semester-VIII**

S. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	MSE	TA	Lab	Total		
1.	PEC	Program Elective Course III* Sustainable Bio-Energy Recourses, Bioprocess Equipment Design	TBE 452 TBE 454	4	3	1	0	30	20	-	50	50	100
2.	PEC	Program Elective Course IV* Instrumentation and Control in Bioprocesses, Biomaterial Science & Engineering	TBE 456 TBE 458	4	3	1	0	30	20	-	50	50	100
3.	OEC (Biochem)	Biotechnology Entrepreneurship	TBE 492	4	3	1	0	30	20	-	50	50	100
4.		Project	TBE498	10	0	0	20	-	50	-	50	50**	100
Total Credits: 22												400	

*These courses are either MOOC/NPTEL online courses of equal weightage and similar title available at the start of the semester OR regular courses in case students do not opt industry-based project.

** Project Viva-Voice will be conducted by External Examiner.

List of Program Elective Courses

S. No.	PEC Names	Subject Name	Subject Code	C (L-T- P) (new)
1	Program Elective Course I	IPR & Biosafety regulation	TBE 455	3 (3-0-0)
		Food Biotechnology	TBE457	
2	Program Elective Course II	Plant Cell Biotechnology	TBE 459	3 (3-0-0)
		Novel Bioproducts	TBE 461	
3	Program Elective Course III	Sustainable Bio-Energy Recourses	TBE 452	4 (3-1-0)
		Bioprocess Equipment Design	TBE 454	
4	Program Elective Course IV	Instrumentation and Control in Bioprocesses	TBE 456	4 (3-1-0)
		Biomaterial Science & Engineering	TBE 458	

List of Open Elective Courses

S. No.	OEC Names	Subject Name	Subject Code	C (L-T-P)
1.	Open Elective Course I (Humanities)	Entrepreneurship Development	HHS 341	3 (3-0-0)
2.	Open Elective Course II (Maths)	Operations Research	BMA 342	3 (3-0-0)
3.	Open Elective Course III (Biochem) (Except Biochemical Engg. Students)	Principles of Biochemical Engineering	TBE 491	3 (3-0-0)
4	Open Elective Course IV (Biochem) (Except Biochemical Engg. Students)	Biotechnology Entrepreneurship	TBE 492	4 (3-1-0)